

11. one current characteristic of a load current and voltage fluctuations in at least one voltage characteristic of a line voltage, said discriminator circuit detecting an upstream transient event when said current fluctuations and said voltage fluctuations are in phase, and said discriminator circuit detecting a downstream transient event when said current fluctuations and said voltage fluctuations are out of phase.

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11. An arc fault protection device, protective of a branch circuit portion of a power line electrical distribution system and connected to a load, comprising:

a first sensor for detecting current fluctuations in at least one current characteristic of load current;

a second sensor for detecting voltage fluctuations in at least one voltage characteristic of a line voltage; and

a discriminator for comparing the polarities of said voltage fluctuations and said current fluctuations, wherein said comparison indicates whether an arc fault or arc mimicking noise is located in said branch circuit portion or located in a remainder of said electrical distribution system based on the comparison of the polarities.

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41. An arc fault protection device, protective of a branch circuit portion of an electrical distribution system and connected to a load, comprising:

means for detecting current fluctuations in at least one current characteristic of a load current;

means for detecting voltage fluctuations in at least one voltage characteristic of a line voltage; and

means for comparing the polarities of said voltage fluctuations and said current fluctuations, wherein said comparison indicates whether an arc fault or arc mimicking noise is located in said branch circuit portion or located in a remainder of said electrical distribution system based on the comparison of the polarities.

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42. A method for protecting a branch circuit portion of an electrical distribution system from an arc fault, said branch circuit portion being connected to a load, comprising the steps of:

detecting current fluctuations in at least one current characteristic of load current;

detecting voltage fluctuations in at least one voltage characteristic of a line voltage;

and

comparing the polarities of said voltage fluctuations and said current fluctuations, wherein said comparison indicates whether an arc fault or arc mimicking noise is located in said branch circuit portion or located in a remainder of said electrical distribution system based on the comparison of the polarities.

43. The arc fault protection device of claim 11, further comprising:

a high frequency detection circuit configured to detect the current fluctuations and the voltage fluctuations, the voltage fluctuations including instantaneous changes on the line voltage, and the current fluctuations including instantaneous changes on the load current; and

a low frequency detection circuit configured to detect the current fluctuations and the voltage fluctuations, the current fluctuations and the voltage fluctuations including fluctuations in wave amplitudes, wave areas, intervals of the waves, and/or a plurality of harmonics of said fundamental frequency.

45. The method of claim 42, further comprising the steps of:

high frequency filtering a voltage wave and a current wave of said system;

determining whether a relationship exists between instantaneous changes on said high frequency filtered voltage wave and said high frequency filtered current wave of said system, and if so, whether said relationship indicates whether a transient is upstream or downstream;

low frequency filtering said voltage wave and said current wave of said system; and

determining whether fluctuations in wave amplitudes, wave areas, intervals of waves, and/or a change in a plurality of harmonics of said fundamental frequency occur, wherein fluctuations in said low frequency filtered voltage wave in phase with fluctuations in said low frequency filtered current wave indicate that said transient is upstream, and wherein fluctuations in said low frequency filtered voltage wave out of phase with said fluctuations in said low frequency filtered current wave indicates that said transient is downstream.

46. The arc fault detector of claim 1, wherein said upstream/downstream discriminator circuit is configured to detect arc faults when said detector is coupled to a inductive load such that during intervals when a line voltage and a line current are of a same polarity, said discriminator circuit detects when steps in load current and steps in line voltage are in phase for upstream caused transient events, and out of phase for downstream caused transient events, and wherein during intervals when said line voltage and said line current are of